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IS : 5353 - 1969

Indian Standard

SPECIFICATION FOR SCREEN LUMINANCE FOR THE PROJECTION OF 35 mm FILM ON MATT AND DIRECTIONAL SCREENS

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SPECIFICATION FOR SCREEN LUMINANCE FOR THE PROJECTION OF 35 mm FILM ON MATT AND DIRECTIONAL SCREENS

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SPECIFICATION FOR SCREEN LUMINANCE FOR THE PROJECTION OF 35 mm FILM ON MATT AND DIRECTIONAL SCREENS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 6 November 1969, after the draft finalized by the Cinematographic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The general practice now-a-days is to instal screens having partially specular reflection characteristics which, when compared with matt white screens, give an increase of luminance within a limited forward sector. Such screens generally require to be curved about a vertical axis and tilted depending on the geometry of the seating area. This standard specifies requirements applicable not only to matt white screens but also to such directional screens.

0.3 Whilst the requirements that are specified in 3 may be met with matt white screens of a size commensurate with the light source, when the screen is viewed from any seat in the auditorium, they can not generally be complied with from all seats in cinemas equipped with large screens having directional characteristics. With such screens it may be difficult or impossible to achieve the required levels of luminance over the whole area of the screen when viewed from every seat in the auditorium, unless the seating area is limited. The requirements specified in 4, therefore, stipulate the seating area over which they apply in cinemas equipped with directional screen. Nevertheless, every endeavour should be made in the choice, size and curvature of the screen, and particularly in the design of the seating arrangements, to enable the occupants of as many seats as possible to view the screen under satisfactory conditions. A guidance of compliance with the above mentioned requirements are given in Appendix A.

0.4 In preparing this standard assistance has been derived from the following standards:

Draft ISO Proposal screen luminance for the projection of 16 mm, 35 mm and 70 mm films in indoor theatres [Doc: ISO/TC 36 (Secretariat-548) 738]. International Organization for Standardization.

B.S. 1404 : 1961 Specification for screen luminance for the projection of 35 mm film on matt and directional screens. British Standards Institution.

1. SCOPE

1.1 This standard recommends the screen luminance (brightness) for the projection of 35 mm black-and-white and colour cinematograph film on matt white screens and on directional screens. It is intended to be applicable to the types of screen that are in general use at the present time.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Candela (Cd) — The unit of liminous intensity. Its magnitude is one-sixtieth of the luminous intensity of one square centimetre of a blackbody radiator operated at the temperature of solidification of platinum.

2.2 Luminance (in a Given Direction at a Point on the Surface of a Source or a Receptor, or at a Point on the Path of a Beam) — Quotient of the luminous flux leaving, arriving at, or passing through, an element of surface at this point and propagated in directions defined by an elementary cone containing the given direction, by the product of the solid angle of the cone and the area of the orthogonal projection of the element of surface on a plane perpendicular to the given direction. Unit : candela per square metre (cd.m^{-2}).

2.3 Brightness — The attribute of the visual appearance by which an area seems to emit more or less light. This attribute is sometimes referred to as luminosity or ' apparent brightness ' and is not expressed in ordinary photometric terms.

NOTE — A good way of explaining the essential difference between ' brightness ' and ' luminance ' is to quote the following sentence:

An automobile headlight seems to have much higher *brightness* at night than in the day time, but its *luminance* remains unchanged.

2.4 Side — It is a position on the horizontal axis of the projected picture 5 percent of its width inwards from the edge.

3. SCREEN LUMINANCE OF MATT SCREENS

3.1 The luminance of the screen shall be measured by the method and under the conditions specified in Appendix B.

3.2 The luminance, measured from any seat* in the auditorium, shall be as follows:

- a) The luminance of the centre shall be not less than 27 cd/m^2 and not more than 55 cd/m^2 .

*For the purpose of this specification, ' measurement from a seat ' implies that the measurement is made at a height of 1.05 m above the floor.

- b) The luminance of each side measured on the horizontal axis shall have the following values:
 - 1) For non-anamorphic projection, from not less than 60 percent and preferably as near as practicable to 70 percent, of the measured luminance at the centre.
 - 2) For anamorphic projection, from 50 percent to 75 percent of the measured luminance at the centre.

NOTE — It has been observed that a greater variation in the ratio of side-to-centre luminance is tolerable with colour film than with black-and-white film. It has nevertheless been found that under general cinema conditions a luminance at the side greater than 80 percent of the luminance at the centre tends to reduce the artistic quality of the projected picture by reason of a reduction of its apparent brilliance (brightness), and that less than 60 percent is undesirable because of an objectionable falling off of the luminance of the sides and corners, with a consequent reduction in the artistic quality of the picture.

4. SCREEN LUMINANCE OF DIRECTIONAL SCREENS

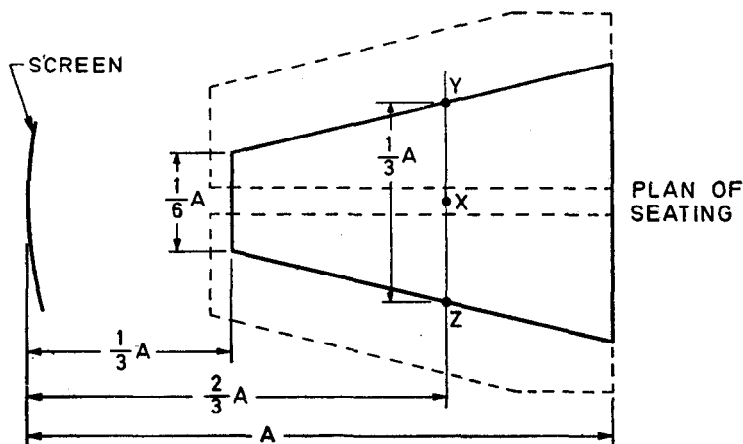
4.1 If with directional screens it is not possible to meet the specifications given in 3, the following requirements shall be substituted:

- a) The luminance of the centre of a directional screen, measured from any seat* in the auditorium within the shaded areas shown in Fig. 1 and 2, shall be not less than 27 cd/m² and not more than 68.5 cd/m².
- b) The luminance of each side (see 2.4) of a directional screen measured on the horizontal axis from seats at positions *X* and *R* shown in Fig. 1 and 2 shall have the following values:
 - 1) For non-anamorphic projection, from not less than 60 percent and preferably as near as practicable to 70 percent, of the measured luminance at the centre.
 - 2) For anamorphic projection, from 50 percent to 75 percent of the measured luminance at the centre.
- c) The luminance of each side (see 2.4) of a directional screen measured on the horizontal axis from seats at the positions *Y* and *Z* shown in Fig. 1 and 2, shall be such that the luminance of the far side shall not be less than 85 percent of the near side and preferably shall be, as near as practicable, equal.

5. STRAY LIGHT

5.1 It is recommended that the level of luminance of the screen due to stray light, from all sources, should not exceed 1 percent of the luminance of the centre of the screen, determined under the conditions given in Appendix B.

*For the purposes of this specification, 'measurement from a seat' implies that the measurement is made at a height of 1.05 m above the floor.



NOTE 1 — The dimension A shall be the distance from the screen to the furthest row of seats measured along the centre line of the auditorium.

NOTE 2 — If in narrow cinemas, positions Y and Z fall outside the auditorium, take for these positions the extreme side seats in the row of seating containing X.

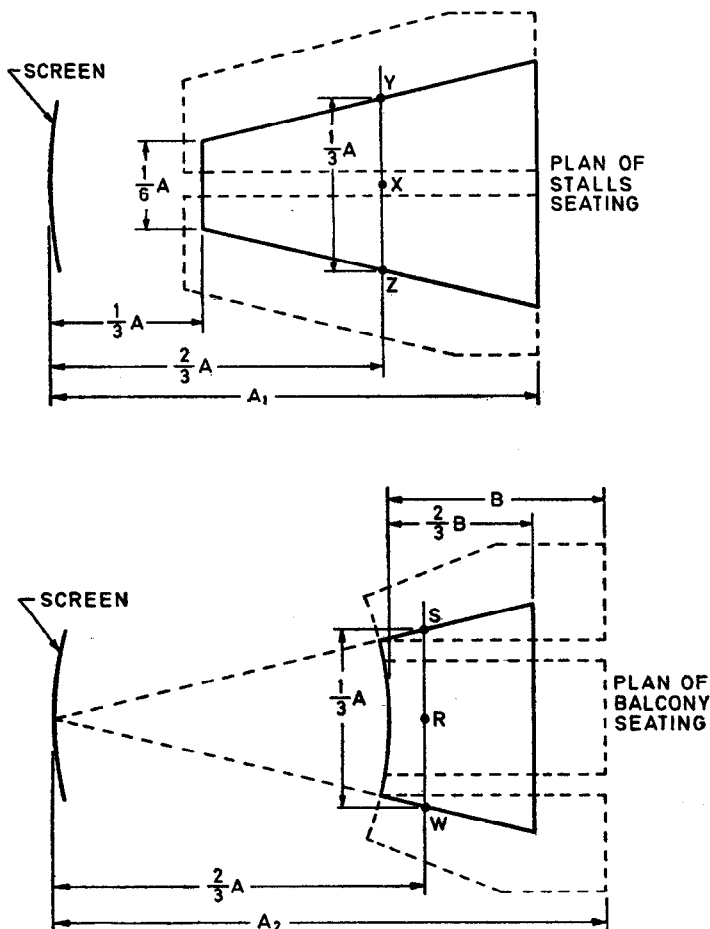
FIG. 1 CINEMAS WITH STALLS LEVEL ONLY, INCLUDING STADIUM TYPES

5.2 It is related to the total of stray light from whatever source. Such sources will include light entering the auditorium from doors and windows, all lighting within the auditorium including that spilled from the projector, whether reaching the screen directly or by reflection from walls and ceiling, and reflected light from the screen re-reflected from walls and ceiling.

5.3 A method of measurement of luminance due to stray light falling on the screen is given in Appendix C.

5.4 With directional (beaded or metallized) screens, the ratio of the luminance of the screen due to stray light to the luminance of the screen due to the projected light, will vary from seat to seat in the auditorium. To determine compliance with **5.1** when directional screens are used, it is necessary for measurements to be made of both projected light luminance and stray light luminance, from a number of seats in the auditorium. Every pair of measurements should give a ratio complying with **5.1**.

5.5 Whilst with levels of stray light up to that quoted above the picture still remains acceptable, it should nevertheless be kept in mind that any stray light whatever tends to degrade the picture to some extent. To achieve black-and-white presentation of good contrast, and colour presentation of good contrast and colour quality, every endeavour should



NOTE 1 — The dimension A shall be the distance from the screen to the furthestmost row of seats measured along the centre line of the auditorium.

NOTE 2 — Dimension $A = A_1$ or A_2 whichever is the greater.

NOTE 3 — If the depth of the balcony is small, such that position R falls in front of it take position R as the centre seat of the front row of the balcony.

NOTE 4 — If in narrow cinemas positions Y and Z , or S and W , fall outside the auditorium, take for these positions the extreme side seats in the row of seating containing X or R , respectively.

NOTE 5 — Where more than one balcony is provided, take only the lowest balcony.

FIG. 2 CINEMAS WITH STALLS AND BALCONY

be made to reduce stray light to a minimum particularly at the lower levels of screen luminance. For high contrast black-and-white pictures, for example, cartoons or line drawings, a level of luminance due to stray light up to 2 percent may not be objectionable.

5.6 The colour of the stray light has an appreciable effect on the acceptability of the picture, particularly in the case of colour film. Stray light which tends to have a pronounced colour will degrade a picture appreciably more than an equivalent level of white light.

APPENDIX A

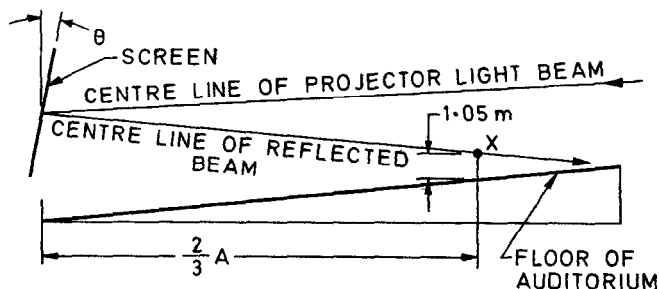
(Clause 0.3)

GUIDANCE ON COMPLIANCE

A-1. Compliance with 4 will require the selection of a screen whose reflection characteristics are compatible (a) with the size and shape of the auditorium, and (b) with the width of the picture and the projection throw.

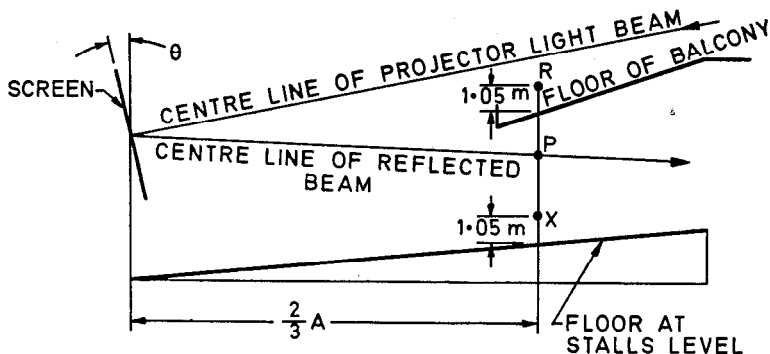
A-2. In most of the cinemas it will be necessary to install a curved screen.

A-3. It will generally be necessary to tilt the screen so that the ray from the projector incident at the centre of the screen is reflected to pass through point *X* (Fig. 3), or point *P* (Fig. 4) which is approximately mid-way between the points *X* and *R*.



NOTE — In the above diagram the angle θ between the screen and the vertical is positive. In a few cases the angle θ between the screen and the vertical will be negative, owing to the direction of the projector light beam relative to the rake of the auditorium floor.

FIG. 3 ANGULAR TILT OF SCREEN: CINEMAS WITH STALLS LEVEL
ONLY INCLUDING STADIUM TYPES



NOTE — In many cases (as illustrated in the diagram) angle θ between the screen and the vertical will be negative owing to the direction of the projector light beam, relative to the rake of the stalls floor, and the rake of the balcony.

FIG. 4 ANGULAR TILT OF SCREEN : CINEMAS WITH STALLS LEVEL AND BALCONY

APPENDIX B

(*Clauses 3.1, 5.1, C-1.1 and C-2.4*)

CONDITIONS AND METHOD FOR MEASURING SCREEN LUMINANCE

B-1. CONDITIONS OF MEASUREMENT

B-1.1 The measurement of the luminance of the screen shall be made under the following conditions, which shall remain constant throughout the complete series of measurements.

B-1.1.1 The projector shall be running under normal operating conditions, with the lens or lenses focused on the film plane but with no film in the gate.

B-1.1.2 The light source and the optical system shall be aligned so that the area of maximum luminance is at the centre of the screen when viewed from any point on the line of the principal reflection of the beam and the levels of luminance at the two sides are substantially equal.

B-1.1.3 The lighting in the auditorium shall be that normally used when a film is being projected.

B-2. PHOTOMETER

B-2.1 The screen luminance shall be measured with a visual photometer in which the screen or a suitable part of it is viewed through a small telescope which has centrally in its field of view a small comparison spot obscuring not more than 1° of this field. The comparison spot is illuminated to a sensibly uniform lance by a small electric lamp, the luminous intensity of which can be adjusted so as to be kept constant. The luminance of the comparison spot is to be capable of variation by suitable means, for example, neutral wedges, so as to be made to match that of the screen whose luminance is required to be measured. The device which alters the luminance of the comparison spot is calibrated so that the luminance of the spot, and hence that of the screen with which it is matched, can be determined.

The error in the indication of the instrument at any point within the effective range shall not exceed 20 percent of the indication.

B-3. NUMBER OF MEASUREMENTS

B-3.1 At least four measurements of the luminance of each selected portion of the screen should be made from each selected position in the auditorium. The mean value of these four measurements shall be regarded as the measured luminance of that portion of the screen as viewed from that position in the auditorium. If more than one observer takes measurements, then each observer should make the same number of observations, which should be not less than four for each observer.

A P P E N D I X C

(*Clause 5.3*)

METHOD OF MEASUREMENT OF LUMINANCE OF SCREEN DUE TO STRAY LIGHT

C-1. GENERAL DESCRIPTION OF THE METHOD

C-1.1 To measure the luminance of the screen due to the incidence, on the screen, of all the stray light that will be present under normal projection conditions, it is necessary to run the projector with the auditorium normally darkened and to project, on to the screen, a quantity of light approximately equal to that projected when an average scene is being shown, and this in practice is about 10 percent of the total light output of the projector. It is necessary to prevent the direct light from the projector lens from falling on a small part of the screen and to measure the luminance of that part. The magnitude of this luminance, expressed as a percentage of the luminance of the centre of the screen under the

conditions of Appendix B, will indicate whether the projection conditions comply with 5.1.

C-2. METHOD OF MEASUREMENT

C-2.1 Darken the auditorium as for normal projection.

C-2.2 Run the projector, using some means to reduce its light output to about 10 percent of the value obtained with no film in the gate. Following are some of the suitable means:

- a) Run a film having overall the picture area a density of 2.0, and having spaced approximately uniformly in the top and bottom thirds of the picture area, a number of clear areas, the sum of these areas being such that the total light incident on the screen is the desired reduced light output.
- b) Insert in the projector gate, or immediately in front of the projection lens, a neutral density filter of such density as to give the desired reduced light output. If a filter is used in front of the lens it should be of a type that does not diffuse or scatter the light falling on it.
- c) Cover the projection lens with a cap having a central circular hole the diameter of which has been determined by trial to give the desired reduced light output.

C-2.3 Place a circular opaque baffle, matt black on both sides, of diameter approximately 10 percent of the picture width, between the projector and the centre of the screen at a distance from the latter equal to one picture width.

NOTE — With a baffle dimensioned and positioned as indicated in C-2.3 the penumbra will be sufficiently small, and the size of the shadow will be adequate (it will subtend an angle of approximately 1 degree at a distance of 5 screen widths). Furthermore, it will be possible to measure the luminance of the shadowed area from any position except within 3 degrees of the normal to the screen passing through the centre of the shadow. The difference between a measurement normal to the screen and the one 3 degrees off is likely to be small (less than 10 percent) even with a beaded screen.

C-2.4 Measure the luminance of the screen in the shadow of the baffle, which is the luminance of the screen due to stray light.

The photometer used for this measurement shall comply with the requirements of B-2.1 and shall be capable of measuring down to at least 0.2 cd/m².

NOTE — In the case where a matt screen is in use and equipment for measuring luminance is not available, the stray light luminance ratio may be determined to a sufficiently close approximation by using an illumination meter. In this case, first measure the illumination at the centre of the screen under the conditions described in Appendix B, and then measure the illumination in the shadow of the baffle under the conditions described in C-2. The ratio of these two illumination values will be, in the case of matt screen, approximately the ratio required.

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